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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/813,330	03/30/2004	Jong-myeong Lee	5649-1205	5124
20792 7590 07/10/2007 MYERS BIGEL SIBLEY & SAJOVEC PO BOX 37428 RALEIGH, NC 27627			EXAMINER EVERHART, CARIDAD	
			ART UNIT 2891	PAPER NUMBER
			MAIL DATE 07/10/2007	DELIVERY MODE PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b>		<b>Applicant(s)</b>	
	10/813,330		LEE ET AL.	
	<b>Examiner</b>		<b>Art Unit</b>	
	Caridad M. Everhart		2891	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 19 April 2007.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-12 and 14-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 19 and 20 is/are allowed.
- 6) ☒ Claim(s) 1,6-12 and 14-18 is/are rejected.
- 7) ☒ Claim(s) 2-5 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 4-19-2007 has been entered.

**Response to Arguments**

Applicant has amended to include the limitation "the aluminum...comes in contact with the upper surface...". Applicant has argued that the claims are now in condition for allowance. The amendment is respectfully found to not place the claims in condition for allowance because elimination of a step of an element and its function is obvious if the function of the element is not desired(MPEP 2144.04(II. a)).

***Claim Rejections - 35 USC § 103***

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1,6,11-13,16, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over anticipated by Teo(US 5,970,374).

Teo discloses the steps of forming an insulative layer of BPSG over a patterned metal or conductive layer in a substrate(col. 7, lines 8-14 and Fig. 3C and 4C show

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substrate 10 with conductive region 12 or conductor 54 on the substrate). An opening is formed in the insulative layer(col. 7, lines 15-18), which is an intaglio pattern. A barrier is formed of Ti or TiW or TiN or a bilayer of Ti and TiN(col. 3, lines 30-38). A protective layer of SOG is formed on the barrier(col. 5, lines 65-67 and col. 6, lines 1-5). CMP is used to remove the layer of SOG and barrier layers on the dielectric, while leaving the SOG in the opening(col. 4, lines 48-58 and Fig. 3B). The SOG is removed from the opening(col. 4, lines 58-62 and Fig. 3C) after the polishing step. Then the opening is filled with tungsten(col. 5, lines 4-9) or by aluminum (col. 6, lines 45-50). The plug is then planarized(col. 5, lines 8-33). The SOG is removed using an HF solution, which is a fluoric acid containing solution(col. 4, lines 59-63).

It is shown in Fig. 3C that Teo teaches the removal of the flowable material from inside and outside the opening or intaglio pattern. It is seen that the barrier layers are also removed by CMP from the top of the oxide layer(Fig. 3C and col. 4, lines 45-54). The limitation of the conductor which is then deposited coming in contact with the top of the insulation layer is satisfied because the conductor may be more than one layer. The Ti/TiN layer which is then deposited under the tungsten layer is an additional barrier/glue layer combination under the tungsten layer(col. 4, lines 65-67). This Ti/TiN layer is understood to be a part of the composite conductive layer. The conductive layer may include only the Ti layer(col. 7, lines 1-8).

The aluminum conductive layer does not come into contact with the upper surface in the method taught by Teo.

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It would have been obvious to one of ordinary skill in the art at the time of the invention to have eliminated the Ti layer in the method taught by Teo because elimination of a step of an element and its function is obvious if the function of the element is not desired(MPEP 2144.04(II. a)). Teo discloses that when the opening is filled with aluminum or aluminum alloy, a Ti glue layer is deposited(col. 8, lines 1-7). In the case in which the glue layer function is not desired, eliminating the glue layer is obvious.

***Claim Rejections - 35 USC § 103***

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 7, 8,9,10, 14, 15, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Teo as applied to claim 1 above, and further in view of Anma et al(US2002/0072195A1) .

Teo is silent with respect to the etch selectivity of the SOG, with respect to the details of the deposition of the aluminum, and with respect to photoresist as the protective layer, although Teo does disclose that ashing is the method of removing photoresist(col. 4, lines 12-16), and is silent with respect to the CMP for the tungsten fill layer.

With respect to the selectivity of the SOG, because Teo discloses BPSG as the insulative layer, it is well known in the art that SOG and BPSG have etchants which are selective to one or the other of the two materials, so that it would have been obvious to one of ordinary skill in the art at the time of the invention to have chosen etchants selective to the SOG in order to remove the SOG.

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It would have been obvious to one of ordinary skill in the art at the time of the invention to have deposited the aluminum by CVD and reflow in order to fill the opening completely because CVD and reflow of aluminum fill layers is conventional in the art.

Anma et al disclose that photoresist may be used rather than SOG in a protective layer process for protecting partially filled openings(paragraph 0101) and that the tungsten fill is planarized by CMP.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have used photoresist and to have planarized by CMP in the process taught by Teo as disclosed by Anma et al because the photoresist would serve the protective function just as SOG does in the process taught by Teo and because CMP is conventional in the art in the planarization of tungsten fill layers.

***Allowable Subject Matter***

Claims 19 and 20 are allowed.

Claims 2-5 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The prior art of record not relied upon is considered relevant to applicant's disclosure. Sardella is cited for its disclosure of a method in which the barrier is removed while the barrier in the opening is protected by using an SOG plug, and the aluminum is deposited without an additional glue layer.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Caridad M. Everhart whose telephone number is 571-272-1892. The examiner can normally be reached on Monday through Fridays 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, B. Baumeister can be reached on 571-272-1722. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

*C. Everhart*  
CARIDAD EVERHART  
PRIMARY EXAMINER

C. Everhart  
7-2-2007